Year 12 Biology Curriculum Overview

Rationale: The Year 12 Biology curriculum is designed to further explore and investigate Biology by building a mind-set that allows skills to be continuously developed. Students will study and experience modules such as, Cells, Biological molecules, Genetic diversity and Exchange of substances. In doing so, pupils will develop their practical and investigative skills.

Term/Length of Time	Outline	Assessment/Teacher Feedback Opportunities	Homework and Literacy resources
Autumn 25 lessons (including assessment and responding to feedback lessons)	<u>Biological Molecules</u> Students will build on their knowledge and skills about biological molecules from Y8 and GCSE Biology to learn about carbon based compounds that interact in similar ways. Students will learn that: Carbohydrates are commonly used by cells as respiratory substrates. They also form structural components in plasma membranes and cell walls. Lipids have many uses, including the bilayer of plasma membranes, certain hormones and as respiratory substrates. Proteins form many cell structures. They are also important as enzymes, chemical messengers and components of the blood. Nucleic acids carry the genetic code for the production of proteins. The genetic code is common to viruses and to all living organisms, providing evidence for evolution. The most common component of cells is water; hence our search for life elsewhere in the universe involves a search for liquid water.	**Biological molecules and Nucleic acids** end of topic assessment in the style of exam questions Written and verbal feedback given throughout module through in-class activities and homework.	Homework is set weekly and contains a mixture of recall exam-style questions as well as more detailed application based exam style questions. All homework is reviewed with at least one detailed FAR (Feedback, Action, Response) marked by the teacher approximately once every 2 weeks **Optional homework tasks and Literacy resources:** SoL on science shared area, including PowerPoints, details of practical investigations, worksheets, revision resources, a range of AFL (assessment for learning) activities, research based tasks, model answers, short answer questions, exam questions, mark schemes, examiner's reports as well as homeworks. Biology offers many opportunities to develop and extend students' literacy skills. There is a large amount of new, subject-specific vocabulary, and so each unit includes a PLC (Personnel Learning checklist) which students will engage with throughout the unit. Students will use texts to find out information for themselves, using the functional layout of such texts, including index,

	Skills: • Interpret the results of, qualitative tests for reducing sugars, non-reducing sugars and starch. • Interpret the results of, the emulsion test for lipids. • Interpret the results of, a biuret test for proteins. • Investigation into the effect of a named variable on the rate of an enzymes controlled reaction. Cells: Students will build on their knowledge and skills about cells from Y7, Y9 and GCSE Biology to learn that: All cells arise from other cells, by binary fission in prokaryotic cells and by mitosis and meiosis in eukaryotic cells. All cells have a cell-surface membrane and, in addition, eukaryotic cells have internal membranes. The basic structure of these membranes is the same and enables control of the passage of substances across exchange surfaces by passive or active transport. Cell-surface membranes contain embedded proteins. Some of these are involved in cell signalling – communication between cells. Others act as antigens, allowing recognition of 'self' and 'foreign' cells by the immune system. Interactions between different types of cell are involved in disease, recovery from disease		contents and glossary sections of text books used in class, and also at home in an online format. Students will also review and connect information within topics. **Useful websites:** https://www.freesciencelessons.co.uk/a-level-revision-videos/a-level-biology/ https://www.physicsandmathstutor.com/biology-revision/a-level-aqa/ https://tailoredtutors.co.uk/subjects/biology/ https://app.senecalearning.com/dashboard **YouTube Channels:** https://www.youtube.com/@MissEstruchBiology/videos https://www.youtube.com/@MrPollockBiology/videos https://www.youtube.com/@AlevelBiologyHelp **Reading list:** Biodiversity: A Beginner's Guide John Spicer Oneworld Publications, 2006. The Diversity of Life (Revised edition) Edward O. Wilson Penguin, 2001. Ever Since Darwin: Reflections in Natural History Stephen Jay Gould W.W. Norton and Co., 1992.
35 Lessons (including assessment and responding to feedback lessons)		**Cells, transport across membranes and Immunology** end of topic assessment in the style of exam questions Written and verbal feedback given throughout module through in-class activities and homework.	

	and prevention of symptoms occurring at a later date if exposed to the same antigen, or antigen-bearing pathogen. <u>Skills:</u> • Measure and calculate actual and image sizes of cells • Calculate the mitotic index of root tip cells by preparing microscope slides to use with the optical microscope • Production of a dilution series of a solute to produce a calibration curve with which to identify the water potential of plant tissue. • Investigation into the effect of a named variable on the permeability of cell-surface membranes. • Plot the data from investigations in an appropriate format.		Field Guide to Bacteria Betsy Dexter Dyer Cornell University Press, 2003. Fifth Miracle: The Search for the Origin of Life Paul Davies Simon and Schuster, 1998. Genome: Autobiography of a Species In 23 Chapters Matt Ridley Fourth Estate, 2000 The Greatest Show on Earth: The Evidence for Evolution Richard Dawkins Black Swan, 2010 How We Live and Why We Die: The Secret Lives of Cells Lewis Wolpert Faber and Faber, 2010 On the Origin of Species (Revised edition) Charles Darwin OUP, 2008. The Origin of Life J.D. Bernal Weidenfeld and Nicholson, 1969 Plant Physiology (Biology: Form and Function) Irene Ridge Hodder and Stoughton, 1991. The Rough Guide to Genes and Cloning Jess Buxton Rough Guides, 2007. The Selfish Gene Richard Dawkins OUP, 2006. Understanding the Human Genome Project. 2nd edition. Palladino, Michael A. Pearson Education, 2005.
26 lessons (including assessment and responding to feedback lessons)	<u>Organisms exchange substances with their environment</u> Students will build on their knowledge and skills about cells from Y7, Y9 and GCSE Biology to learn that: The internal environment of a cell or organism is different from its external environment. The exchange of substances between the internal and external environments takes place at exchange surfaces. To truly enter or leave an organism, most substances must cross cell plasma membranes.	**Exchange and mass transport** end of topic assessment in the style of exam questions Written and verbal feedback given throughout module through in-class	

	In large multicellular organisms, the immediate environment of cells is some form of tissue fluid. Most cells are too far away from exchange surfaces, and from each other, for simple diffusion alone to maintain the composition of tissue fluid within a suitable metabolic range. In large organisms, exchange surfaces are associated with mass transport systems that carry substances between the exchange surfaces and the rest of the body and between parts of the body. Mass transport maintains the final diffusion gradients that bring substances to and from the cell membranes of individual cells. It also helps to maintain the relatively stable environment that is tissue fluid. <u>Skills:</u> • Use dimensions of cells with different shapes from which to calculate the surface area to volume ratios of these cells. • Dissect mammalian lungs or the gas exchange system of a bony fish. • Calculate values of pulmonary ventilation rate (PVR) • Calculate cardiac output and other cardiac measures • Analyse a potometer to investigate the effect of a named environmental variable on the rate of transpiration.	activities and homework.	Viruses: A Very Short Introduction Dorothy H. Crawford OUP, 2011. What Mad Pursuit Francis Crick Penguin, 1990. Junk DNA: A Journey through the Dark Matter of the Genome Nessa Carey Icon Books Ltd, 2015 Immune: A journey into the mysterious system that keeps you alive Philipp Dettmer Random House, 2021
27 lessons	<u>Genetic information, variation and relationships between organisms</u>		

(including assessment and responding to feedback lessons)	Students will build on their knowledge and skills about genetics and relationships between organisms from Y8 and GCSE Biology to learn that: Biodiversity is reflected in the vast number of species of organisms, in the variation of individual characteristics within a single species and in the variation of cell types within a single multicellular organism. Differences between species reflect genetic differences. Differences between individuals within a species could be the result of genetic factors, of environmental factors, or a combination of both. A gene is a section of DNA located at a particular site on a DNA molecule, called its locus. The base sequence of each gene carries the coded genetic information that determines the sequence of amino acids during protein synthesis. The genetic code used is the same in all organisms, providing indirect evidence for evolution. Genetic diversity within a species can be caused by gene mutation, chromosome mutation or random factors associated with meiosis and fertilisation. This genetic diversity is acted upon by natural selection, resulting in species becoming better adapted to their environment. Variation within a species can be measured using differences in the base sequence of DNA or in the amino acid sequence of proteins. Biodiversity within a community can be measured using species richness and an index of diversity. <u>Skills:</u>	**DNA, genes & protein synthesis, genetic diversity and biodiversity** end of topic assessment in the style of exam questions Written and verbal feedback given throughout module through in-class activities and homework.	

	• use the expression 2n to calculate the possible number of different combinations of chromosomes following meiosis, without crossing over • derive a formula from this to calculate the possible number of different combinations of chromosomes following random fertilisation of two gametes, where n is the number of homologous chromosomes pairs. • Use of aseptic techniques to investigate the effect of antimicrobial substances on microbial growth. • Use data from which to calculate an index of diversity and interpret the significance of the calculated value of the index. • Use standard scientific calculators to calculate the mean values of data they have collected or have been given. • Calculate, and interpret the values of, the standard deviations of their mean values.			